

WHAT IS CLAIMED IS:

1. A rotational driving apparatus comprising:
 - a stepping motor supported by a housing;
 - an output shaft rotationally supported by the housing and driven by the stepping motor;
 - a rotational position detecting sensor for outputting a detected voltage in response to a rotational position of the output shaft ; and
 - a position detecting means for detecting the rotational position of the output shaft in accordance with the detected voltage from the rotational position detecting sensor,
 - wherein the position detecting means comprises;
 - a means for determining that the output shaft is in a good operational order
 - when a first detected voltage of the output shaft at its first detection position (Step=0) and a second detected voltage of the output shaft at its second detection position (Step=n), to which the output shaft has been rotated by the stepping motor by a predetermined number of control pulses, are respectively within a predetermined error range; and
 - when a differential voltage between the first and second detected voltages corresponding to the predetermined number of control pulses between the first and second detection positions is within a certain differential voltage span.

2. A rotational driving apparatus according to Claim 1,

wherein the certain deferential voltage span means a span from a first deferential voltage to a second deferential voltage, wherein the first deferential voltage is a deferential voltage between the maximum value of a second error range at the first detection position (step:0) and the minimum value of the second error range (E2) at the second detection position (step:n), whereas the second deferential voltage is a deferential voltage between the minimum value of the second error range at the first detection position (step:0) and the maximum value of the second error range at the second detection position (step:n).

3. A rotational driving apparatus according to Claim 2, wherein the error ranges are error ranges covering errors possibly included the detected voltages, and the second error range is narrower than the first error range.

4. A rotational driving apparatus according to one of Claims 1 to 3,

wherein the first detection position is a reference position of the output shaft and the second detection position is a position which is a maximum position to which the output shaft can be rotated.

5. A rotational driving apparatus according to Claim 1, further comprising:

a position initializing means for rotating the output shaft in a reverse direction until the output shaft impinges against a stopper and then rotating the same in a forward direction by a predetermined number of steps,

wherein the determining means detects, as the first detected voltage, the output voltage from the rotational position detecting sensor at an initial position of the output shaft before it will be rotated by the position initializing means,

the determining means further detects, as the second detected voltage, the output voltage from the rotational position detecting sensor at a position of the output shaft which has been rotated by the predetermined number of control pulses by the position initializing means, and

the determining means determines whether the output shaft is positioned at its reference position by determining the differential voltage between the first and second detected voltages is within the certain differential voltage span as a third error range.

6. A rotational driving apparatus according to Claim 5, further comprises a return initializing means for rotating the output shaft in the reverse direction until the output shaft impinges against the stopper and then rotating the same in the forward direction until the output shaft comes to the reference position, when the determining means determines that the output shaft is not positioned at its reference position after the operation of the position initialing means.

7. A rotational driving apparatus according to Claim 6, wherein the return initializing means calculates

a number of steps representing the present position of the output shaft, and

a necessary number of stepping pulses for rotating the output shaft in the reverse direction from the present position to such a position where the output shaft impinges against the stopper means,

based on the detected voltage from rotational position detecting sensor and a predetermined formula between a number of steps and a minimum value of the error range for the detected voltages.

8. A rotational driving apparatus according to Claim 7, wherein

the return initializing means calculates a necessary number of stepping pulses for rotating the output shaft in the reverse direction from the present position to such a position where the output shaft becomes within the reference position error range,

the return initializing means drives the output shaft to rotate the same by such number of stepping pulses at a first rotational speed, and then to rotate the output shaft at a second rotational speed slower than the first rotational speed.

9. A rotational driving apparatus according to Claim 8, wherein

the return initializing means increases amounts of electric current and electric voltage to be applied to the stepping motor by a predetermined values, when the output shaft will be rotated in the reverse direction at the first rotational speed.

10. A rotational driving apparatus according to Claim 1, wherein the output shaft is operatively connected to the stepping

motor through a multistage speed reduction gear mechanism.

11. A rotational driving apparatus according to Claim 1, further comprising a spring means for urging the output shaft in one rotational direction.

12. A rotational driving apparatus according to Claim 1, wherein the rotational driving apparatus is connected to a steering angle sensor for a steering wheel of a motor vehicle so that a steering control signal is transmitted from the steering angle sensor to the rotational driving apparatus, and

wherein the output shaft of the rotational driving apparatus is operatively connected to headlights of the motor vehicle so that an optical axis of the headlights will be moved in response to a steering angle of the steering wheel.